

## REMARKS

Claims 4-16 have been added; thus, claims 1 and 3-16 are pending. No new matter was added. For reasons stated below, Applicants respectfully submit that the claims of the present application are patentable over the prior art of record. Accordingly, Applicants respectfully submit that the present application is in condition for allowance.

### I. Claim Rejections - 35 USC §103(a)

- A. *In the Office Action, claim 1 is rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 2,799,080 issued to Duckworth.*

The Duckworth patent discloses a bearing made of a matrix of a relatively hard metal or alloy **in which lead or a lead alloy is required to be dispersed**. (See column 1, lines 17-19.) The specific hard metal matrix disclosed by Duckworth is an iron-lead-sulfur material. (See column 1, lines 35-38, and column 3, lines 9-20.) Thus, all embodiments of Duckworth require lead or lead alloy to be dispersed therein.

According to one specific embodiment of a bearing disclosed by Duckworth, a composite bearing is provided. (See column 1, line 26, and column 2, lines 17-29.) The composite bearing includes a copper-plated steel “backing” (see column 2, lines 30-32) and an “interlayer” of the hard metal iron-lead-sulfur matrix material bonded to the backing. The composite bearing can also include a soft metal “lining” made of “**a soft metal such as lead, tin, cadmium or an alloy of one of such metals**”. (See column 1, line 29; column 2, lines 22-26; and column 3, lines 55-58.)

The only reference to indium in the Duckworth patent is on column 3, lines 61-62 and 68-69, and column 4, lines 4-10. Duckworth discloses that a “lining” made of lead may include “tin,

indium or thalium”. The content amount, location within the lining, and purpose of the pure metal indium is not discussed in Duckworth.

However, it is clear that the bearings disclosed by Duckworth are directed to those providing an anti-wear property. For example, on column 2, lines 66-71, Duckworth states that the “contact angle” can be reduced. One of skill in the art would realize that reducing the “contact angle” provides an improvement relative to the anti-wear property of the bearing.

It is clear from a fair reading of the Duckworth patent that Duckworth fails to identify problems with respect to rust or improvements relating to providing bearings with a rustproof property. Further, Duckworth certainly fails to disclose how to rustproof an iron-based sintered body.

Turning to claim 1 of the present application, it requires an iron-based sintered body having a surface containing 0.01 to 5at% of indium for the purpose of providing a rustproof iron-based sintered body. As admitted by the Examiner, Duckworth fails to disclose the limitation requiring indium content of 0.01 to 5at%. Applicants further submit that Duckworth also fails to disclose a bearing having a rustproof property and fails to disclose that the required content of indium be provided on the “surface” of the sintered body.

Rust occurs on the surface, and for the indium to provide the desired rustproofing effect, it must be present on the surface. In the present invention, the placement of the indium on the surface is accomplished by introducing indium vapor into a furnace under a gas atmosphere so that, during sintering, 0.01 to 5at% of indium is applied by deposition directly on the surface of the iron-based body.

In contrast, Duckworth merely requires a soft metal lining of lead be applied on a composite bearing. The lead lining can include indium applied as a pure metal in a molding,

compact, or casting of the bearing before sintering. The indium will be dispersed within the lining and may diffuse into the interlayer of the bearing. Thus, Duckworth not only fails to disclose the claimed content of indium, but also fails to disclose the claimed placement of the indium on the surface of the composite bearing. Applicants respectfully submit that this placement would not be obvious to one of ordinary skill in the art because Duckworth relates to a wear resistant composite bearing having a soft metal lining and fails to address or admit any problems with respect to rust or how to deposit indium via sintering. Thus, while the composite bearing of Duckworth may contain an undisclosed amount of indium, it fails to disclose the content and location of the indium on the surface of the bearing or how to deposit the indium on the surface in manner permitting it to provide a rustproofing function.

For these reasons, Applicants respectfully submit that claim 1 is patentable and not obviated by the Duckworth patent. One of skill in the art using only routine skill and knowledge would not be able to obtain the iron-based sintered body having a rustproof outer surface of the present invention merely by following the teachings of Duckworth. Accordingly, Applicants respectfully request reconsideration and removal of the obviousness rejection of claim 1.

New claims 12-16 have been added and are directed to an iron-based sintered body similar to claim 1. No new matter was added. The subject matter of claim 12 is disclosed by: claims 1 and 2 as filed; page 2, line 27, to page 3, line 1; and page 3, line 27 of the present application. The subject matter of claim 13 is disclosed on page 5, lines 10-12, of the present application, and the subject matter of claims 14-16 is disclosed on page 4, lines 7-23, and page 8, line 24, to page 9, line 18, of the present application, as filed.

Claim 12 states the location of the indium content on the outer surface of the sintered body and requires the outer surface to be a rustproof outer surface. As stated above, Duckworth

fails to disclose rustproofing, the required content of indium, and its location on the outer surface. Accordingly, Applicants submit that claim 12 is non-obvious and patentable over Duckworth.

Claims 13-16 specify the materials from which the sintered body is made. These materials do not include lead or a lead alloy. Duckworth is directed to bearing materials requiring the presence of lead or lead alloys and teaches away from bearings that do not include lead. Accordingly, one of skill in the art following the teachings of Duckworth would include lead or a lead alloy in the bearing material and thus would be directed away from the invention required by claims 13-16 of the present application. Accordingly, Applicants submit that claims 13-16 are non-obvious and patentable over Duckworth.

*B. In the Office Action, claim 3 is rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 2,799,080 issued to Duckworth in view of the ASM Handbook publication.*

The Duckworth patent is discussed above in detail. The Examiner states that the “ASM Handbook teaches that it is known to use gas atmosphere during sintering”.

Applicants respectfully submit that Duckworth and the ASM Handbook both clearly fail to disclose the introduction of indium vapor in a gas atmosphere during sintering for the purpose of depositing 0.01 to 5at% of indium on the outer surface of an iron-based body during sintering to thereby provide the iron-based sintered body with a rustproof outer surface.

The ASM Handbook states the purpose of gas atmospheres on page 457, as follows:

“... A basic function of a sintering atmosphere is to *protect* metal parts from the effects of contact with air. Atmospheres must be maintained at a sufficient pressure and flow rate to *prevent infiltration of air* through furnace openings. In addition to protecting the part, atmospheres provide sufficient

conduction convection for *uniform heat transfer* to ensure even heating or cooling within the various furnace zones.”

Accordingly, the ASM Handbook fails to disclose the introduction of indium in a gas atmosphere and fails to disclose the purpose of introducing the indium into the gas atmosphere. One of skill in the art following the teachings of Duckworth and the ASM Handbook would first mold or cast pure indium into the bearing and then would perform sintering under a gas atmosphere. However, the indium would be embedded and dispersed within the bearing and would not be located on the outer surface and provide a rustproofing function. Both Duckworth and the ASM Handbook clearly fail to teach applying indium to an iron-based body by introducing indium vapor within a furnace during sintering so that indium deposits on the outer surface of the iron-based body and provides a rustproofing function.

Claim 3 of the present application requires a method of manufacturing an iron-based sintered body. The iron-based body has iron as its principal component and is sintered in a gas atmosphere containing indium vapor or indium. As stated above, Duckworth and the ASM Handbook fail to provide such a method or even the reasons for using such a method. Neither reference addresses problems of rust on an iron-based sintered body nor discloses introducing indium vapor or indium in a gas atmosphere during sintering. Accordingly, Applicants respectfully submit that claim 3 is patentable over Duckworth in view of the ASM Handbook and request reconsideration and removal of the obviousness rejection.

New method claims 4-11 have been added and depend directly or indirectly from base independent method claim 3. No new matter was added. The subject matter of claim 4 is disclosed on page 2, line 27, to page 3, line 1 and page 3, line 27, of the present application, as filed. The subject matter of claims 5-7 is disclosed on page 5, lines 13-17, of the present

application, and the subject matter of claims 8 and 9 is disclosed on page 3, lines 22-24, and page 4, lines 5-6, of the present application, as filed. The subject matter of claim 10 is disclosed on page 5, lines 10-12, of the present application, and the subject matter of claim 11 is disclosed on page 4, lines 7-23, and page 8, line 24, to page 9, line 1, of the present application, as filed.

Applicants respectfully submit that providing an iron-based body with a rustproof outer surface containing 0.01 to 5at% of indium during sintering would not be obvious to one of ordinary skill in the art following the teachings of Duckworth and the ASM Handbook. In Duckworth, pure indium must be cast or molded into the bearing and is only then subjected to sintering. Duckworth fails to disclose, suggest, or teach applying indium from indium vapors present in a gas atmosphere during sintering. The ASM Handbook also fails to disclose such an application of indium. Accordingly, Applicants respectfully submit that claim 4 is patentable over Duckworth in view of the ASM Handbook.

For like reasons, Applicants submit that introducing indium vapor into a furnace during sintering (claim 7) is not fairly disclosed or taught by the cited references. Further, Applicants submit that introducing a compound that contains indium and that decomposes with the heat of sintering (claim 8) is not fairly disclosed by the cited references. Still further, Applicants submit that the use of indium suboxide ( $\text{In}_2\text{O}$ ) (claims 9) or the mixtures required by claims 10 and 11, which do not include lead, are neither disclosed nor obviated by Duckworth and the ASM Handbook. Accordingly, Applicants respectfully submit that claims 5-11 are patentable over Duckworth in view of the ASM Handbook.

### **III. Conclusion**

In view of the above remarks, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

Respectfully submitted,  
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